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**Docket No.: 18117
[TYC-03-1111]**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: **William J. Palmteer et al.**

Examiner: **D. Kang**

Serial No.: **10/696,005**

Group Art Unit: **2811**

Filed: **October 29, 2003**

For: **SURFACE MOUNT PACKAGE FOR A HIGH POWER LIGHT EMITTING DIODE**

AFFIDAVIT OF PRIOR INVENTION UNDER 37 CFR 1.131

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

I, WILLIAM J. PALMTEER, being duly sworn, depose and state:

1. I was an applicant of the above-identified patent application at the time of filing, and a co-inventor of the subject matter described and claimed therein.
2. On or about January 22, 2003, I (in concert with my co-inventors Thomas Yuan and Richard Koba) submitted a Preliminary Invention Disclosure ("PID") to my employer The Whitaker Corporation ("Whitaker") which described surface mount packages for high power light-emitting diodes (LEDs) (See Exhibit A).
3. Included as "Attachment A" to the above-referenced PID was a document entitled "Surface Mount Ceramic Packages for High Power LEDs" which I and my co-inventors had previously authored on or before January 22, 2003.
4. It is my understanding that Whitaker in-house counsel Joseph A. Tessari, Esq. received the PID on April 23, 2003 and subsequently began working towards the preparation of a Patent Application based on the PID. This receipt date is evidenced by the "Whitaker" date stamp on the first page of the PID.
5. I also understand that Mr. Tessari forwarded the PID to Mr. Joseph Chovanes of the law firm of Piper Rudnick LLP ("Piper Rudnick") on or about April 24, 2003, and requested that Mr. Chovanes prepare a Patent Application based on the PID (See Exhibit B).

6. On October 27, 2003, I signed a Declaration and Power of Attorney authorizing Whitaker subsidiary Tyco Technology Resources, and the law firm of Piper Rudnick, to file a Patent Application covering the idea of surface mount packages for high power light-emitting diodes (See Exhibit C).
7. I understand that the Patent Application was filed on October 29, 2003 with the United States Patent & Trademark Office by Piper Rudnick, and was accorded Serial No. 10/696,005.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Signed at M/A-Com Fed Lowell, Ma., this 15th day of April, 2005.

WILLIAM J. PALMTEER

William J. Palmteer

STATE OF MASS :
: SS.
COUNTY OF Middlesex :

Before me, a Notary Public for said County, personally appeared WILLIAM J. PALMTEER, known to me to be the person who executed the foregoing affidavit and acknowledged it to be his act and deed.

Witness my hand and seal this 15th day of April, 2005.

Maura Clark
Notary Public
My Commission Expires
August 27, 2010

- REDACTED -

111-03

tyco

Electronics

M/A-COM

HUMAN RESOURCE POLICY

Subject:	Policy #: DIVH-1575	Rev. C
PATENT AWARDS	Page 1 of 2	

PRELIMINARY INVENTION DISCLOSURE

Please complete this form and forward to: John Vaughan, VP Business Development

M/S 122 as ATTACHMENT "A"

Descriptive Title of Invention: Surface Mount Ceramic Packages for High Power LEDs

Date: January 22, 2003

- REDACTED -

What are the new features of the invention which overcome this problem? The LED package is designed to be compatible with automated die attach and wire bonding equipment. The conical feature placed in the top metal will allow reflection of light upwards and outwards external to the package, whereby increasing the lumens.

On separate drawings or sketches, describe the features of the invention and how they work. Are these enclosed? ☒ yes ☐ no

- REDACTED -

Enter date of the first written description or the first dated sketch of invention and attach copies.

Enter the date a working model, device or process was or will be completed:

- REDACTED -

Are latest drawings enclosed? ☒ yes ☐ no Are they CAD? ☒ yes ☐ no
If CAD, who should be contacted to retrieve the CAD files? Bill Palmteer

Inventor's Full Name (Incl. Full Middle Name)	Inventor's Full Name (Incl. Full Middle Name)	Inventor's Full Name (Incl. Full Middle Name)
William Palmteer	Thomas Yuan	Richard Koba
Business Phone: 978-442-4163	Business Phone: 978-442-4216	Business Phone: 978-442-4196
Fax Number: 978-442-4261	Fax Number: 978-442-4261	Fax Number: 978-442-4261
M/A-COM Employee #: 41163	M/A-COM Employee #: 55420	M/A-COM Employee #: 41222
Business Unit: MSBU-PB	Business Unit: MSBU-PB	Business Unit: MSBU-PB
Mail Stop:	Mail Stop:	Mail Stop:
Citizenship: USA	Citizenship: Taiwan, ROC	Citizenship: USA
Home Address: 481 Steven Street N. Andover, MA 01845	Home Address: 4107 Thornwood Lane Williamsville, NY 14221	Home Address: 57 Walnut Street, Saugus, MA 01906
Signature: <i>William J. Palmteer</i>	Signature: <i>Thomas Yuan</i>	Signature: <i>Richard Koba</i>
Date: 1/22/03	Date: 1/22/2003	Date: 1-22-03
Witness: <i>Amir M. Raza 1/22/03</i>	Witness: <i>Amir M. Raza 1/22/03</i>	Witness: <i>Amir M. Raza 1/22/03</i>
Witness: <i>[Signature] 1/24/03</i>	Witness: <i>[Signature] 1/24/03</i>	Witness: <i>[Signature] 1/24/03</i>
Business Unit Mgr's Name and Phone Number:	Business Unit Mgr's Name and Phone Number:	Business Unit Mgr's Name and Phone Number:

M/A-COM

HUMAN RESOURCE POLICY

Subject:	Policy #: DIVH-1575	Rev. C
PATENT AWARDS	Page 2 of 2	

Dr. Doug Carlson 978-656 2932	Dr. Doug Carlson 978-656 2932	Dr. Doug Carlson 978-656 2932
FOR THE WHITAKER CORPORATION USE ONLY		
		PID Number: 2003073
		Attorney: Joseph A. Tessari
		Attorney's Phone: (302) 633-3516

ATTACHMENT B

INVENTION DISCLOSURE and REQUEST FOR PATENT APPLICATION

DATE: 1-22-2003

TITLE OF INVENTION: Surface Mount Ceramic Packages for High Power LEDs
(PID attached)INVENTOR(S):

<u>NAME</u>	<u>EMP ID</u>	<u>BUSINESS UNIT</u>	<u>DEPT.</u>
1. Bill Palmteer	41163	MSBU	28585
2. Thomas Yuan	55420	MSBU	28588
3. Richard Koba	41222	MSBU	28113
4.			

BUSINESS UNIT TECHNICAL REVIEW:BUSINESS UNIT MANAGER(s)
BUSINESS UNIT REVIEW TEAM(s)~~Doug Carlson~~
Doug Carlson
JP Lanteri

2/14/03

Business Unit RECOMMENDATION:

- ☒ Approve for patent application review by Intellectual Property Committee
☐ Recommend no application at this time
☐ Other action required – please explain below:

- REDACTED -

INTELLECTUAL PROPERTY COMMITTEE REVIEW:

INTELLECTUAL PROPERTY TEAM LEAD

INTELLECTUAL PROPERTY TEAM MEMBER(S)

J. Hawk

Intellectual Property Committee DECISION:

- ☐ Approved for patent application review by Whitaker Corporation
☐ No application to be pursued at this time
☐ Additional information required – please explain below:

tyco

Electronics

M/A-COM

HUMAN RESOURCE POLICY

Subject:	Policy #: DIVH-1575	Rev. C
PATENT AWARDS	Page 3 of 2	

FINAL IPC APPROVAL:

Chairperson,
Intellectual Property Committee

Date

Attachment A

M/A-Com Proprietary
Invention Disclosure

Surface Mount Ceramic Packages for High Power LEDs January 22, 2002

Bill Palmteer, Tom Yuan and Richard Koba

1 Surface Mount LED Package Design Elements:

- 1.1 This invention is a surface mount LED package constructed of ceramic, glass and metal. The ceramic layer has pattern metallization that allows die and wire attach of the LED on the top face, and electrical terminations suitable for brazed leads or surface mount soldering on the backside. The ceramic layer enables electrical isolation of the two leads to the diode (anode and cathode), the ability to withstand high temperatures during assembly and operation, resistance to damage by intense UV radiation, and structural stability. The metallization on the ceramic can be designed in such a way as to accept LEDs that are backside die attached or flip chip mounted onto the ceramic. If the LED is backside die attached, then the ceramic metallization can be designed to accept a LED backside that is one electrode of the diode (requiring only one wire bond off the top of the LED), or an LED backside that is electrically insulating (requiring two wire bonds off the top of the die).
- 1.2 A reflector "collar" is attached on the ceramic to surround the die. The purpose of the reflector is to efficiently direct the emitted light upward, protect the die and contain the encapsulant. The reflector should preferably have a parabolic or conical internal diameter. The top surface of the reflector could include machined features that promote alignment and placement of a lens atop the LED. The surface of the reflector is coated with, or comprised of, silver, palladium or aluminum. Preferably, the reflector is made from a metal whose CTE is matched to the CTE of the ceramic.
- 1.3 A dielectric layer must be interposed between the metallized ceramic and the metal reflector to prevent electrical continuity between the two metal pads atop the ceramic. The dielectric can be the same as the ceramic base (cofired or post-fired), requiring that the metal reflector be bonded to the base with a metal braze or a glass. If the dielectric is a silicate glass or a polymer (e.g., epoxy), then this glass layer can also serve as the adhesive between the ceramic base and the metal reflector.

2 Construction of the package:

- 2.1 The ceramic is manufactured in either single units or an array (i.e., multi-up card). It can be bonded to the metal reflector as discrete units or in an array. The ceramic material can be alumina (Al_2O_3) or aluminum nitride (AlN). Alumina is the lower cost material, and is preferred when the dissipated power of the LED is low. AlN is the higher cost material, but is preferred when the dissipated power of the LED is high. Atop alumina, the CTE matched metal can be Alloy 46 or certain compositions of AlSiC. Atop AlN, the CTE-matched metal can be Kovar or Alloy 42.
- 2.2 The metallization pattern on the ceramic must connect the two pads on the top of the ceramic to two pads on the backside. Methods of connecting the two pads to the backside pads include bore-coated castellations (of various shapes), and hermetic and non-hermetic vias.

- 2.3 The metallization must be adherent to the ceramic, capable of withstanding package assembly process, and compatible with the LED die attach (epoxy or solder) and wire bonding (Au or Al wire) of the LED die. Two general methods can be used to metallize the ceramic: thick film or thin film.
- 2.4 *Thick film* metallization offers the advantage of being directly deposited onto the ceramic in the desired pattern. Thin film metal can include a variety of post-fired metallization pastes such as silver (Ag) or gold (Au). Ag or Au thick film metallization has the advantage of being directly adherent to the bare ceramic, and not requiring subsequent plating. Alternatively, refractory metal can be screened onto the ceramic either before or after the ceramic is sintered. The co-fired thick film metal is typically tungsten (W), which enables the creation of hermetic vias. Post-fired refractory metallization can include W, W/Mn or Mo/Mn. All refractory metallization require plating of metals required to support die attach. Typical plated metal layer stacks can include Ni/Ag, Ni/Pd or Ni/Au. However, for optimal reflectivity, the preferred outermost metal should be Ag or Pd.
- 2.5 *Thin film* metallization offers the advantage of offering aluminum metallization, and potentially finer linewidth control. Thin films are deposited by methods such as sputtering or evaporation. Typical thin film systems compatible with ceramic include Ti/Pt/Au, Ti:W/Au, Ti/Pt/Ag or Ti:W/Ag. Sputtered or evaporated aluminum may exhibit sufficient adhesion to bare alumina or AlN. Thin film metal can be patterned by deposition through a shadow mask or photoresist mask, or by a subtractive (etch) process, where the metal to be etched away is defined by photoresist.
- 2.6 If the backside of the ceramic requires metal leads, one method to attach these leads would be to braze the leads discrete ceramic bases using a metal braze alloy such as CuAg eutectic. This lead attachment step can be performed prior to bonding the reflector layer to the top face of the ceramic.
- 2.7 The metal reflector is formed from a sheet of CTE-matched metal such as Alloy 46 or Kovar, typically 20 mils (0.5mm) thick. Two methods can be used to form the sheet metal: photoetching or stamping. Photoetching of metal sheets is commonly practiced in the industry using dry film photoresist. If photoresist is patterned on only one face of the metal, wet (isotropic) etching of the metal will naturally produce a sidewall whose profile is the 90° arc of a circle. However, if photoresist is aligned and patterned on both faces of the metal sheet, then more conical-shaped profile can be engineered. Stamping of sheet metal is preferred when the desired quantities are very high. By using of progressive stamping or forging, the profile of reflector sidewall can be controlled. After forming, the metal can be surface treated to prepare it for bonding to the ceramic. For example, the electroplated with Ni, or Ni + Ag to prepare it to be brazed or glass bonded to the ceramic. Or, the metal could be oxidized to prepare it to be glass bonded to the ceramic.
- 2.8 An alternative reflector metal could be the one of the many types of aluminum matrix composites tailored to have a low CTE. The CTE of the composite can be reduced by the addition of SiC particles (AlSiC), SiC whiskers, silicon particles, or graphite fiber. For example, the firm DMCC manufactures an AlSiC composition called MCX-724 whose CTE is matched to that of alumina (7.2 ppm/°C). Si/Al or graphite/Al can be machined, photoetched or stamped into the desired shape. AlSiC can be net shaped cast into the desired shape, after the expensive NRE has been paid. The advantage of aluminum matrix composite reflectors is that that they require no plating before or after they are bonded to the ceramic (preferably using a low temperature sealing glass), since aluminum is a preferred reflector material and it does not tarnish. Ideally, an aluminum composite can be sealed to the ceramic using a glass sealing temperature > 300°C (to enable the LED to be soldered with AuSn eutectic), but < 500°C to prevent excessive alloying of the Au or Ag plating on the ceramic.

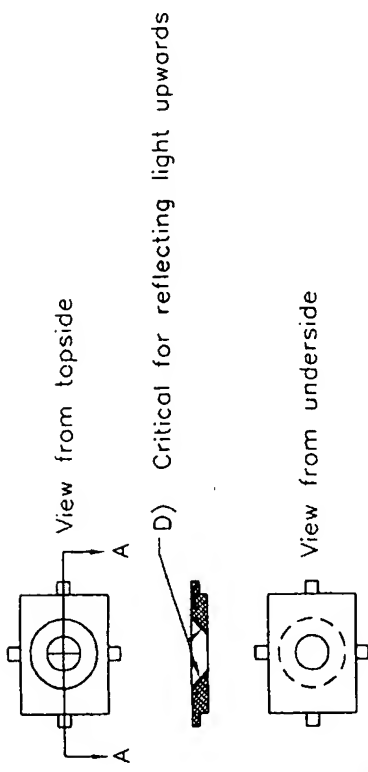
- 2.9 The metal reflector can be etched into the shape of a 2-D array of reflectors. The array can either be (a) tightly spaced together to enable bonding to a ceramic multi-up card, or (b) widely separated as on an overmolded leadframe. If the metal/glass/ceramic sandwich is bonded together as a card, then the sandwich layers must be singulated with a diamond saw, preferably after die attach and wire bonding. If the ceramic is singulated before bonding to the metal, then diamond sawing through the ceramic only is necessary. After the discrete ceramic bases are bonded to the metal lead frame, the metal leadframe can be quickly singulated using an excising punch.
- 2.10 The use of glass to bond the metal to the ceramic offers the advantage of providing dielectric isolation and adhesion in a single step. The selected glass should have a CTE similar to that of the ceramic and the metal, and should have a softening point above 300°C, to enable AuSn die attach of the LED to the ceramic, followed by SnAg wave soldering of the packaged LED. The upper temperature limit of the working temperature of the glass is set by other factors. If a metal alloy such as Alloy 46 or Kovar are used, the glass should be flowed at a temperature below which the thermal expansion coefficient of the metal increases. In such cases, the package will probably be silver plated after assembly. If an aluminum-matrix composite is used as the reflector, then the metallization on the ceramic (such as Ag or Au) must not be degraded in the process of bonding the ceramic to the reflector. The glass reflow temperature should be < 500°C if the ceramic's Ag or Au metallization is not to be degraded.
- 2.11 A polymer such as high temperature epoxy could also be used to bond the metal reflector to the ceramic. Epoxy bonding of the metal to the ceramic would be especially suitable if the LED is to be attached to the ceramic using a lower temperature, silver filled epoxy. Generally, it is easier to control the flow of epoxy than silicate glass.

3 Die attach and wire bonding

- 3.1 A purpose of this invention is to provide an LED package design that is compatible with existing automated methods for die attach and wire bonding. In order to meet the high volume & low unit cost demands of the LED industry, the LED dice must be die attached and wire bonded using highly automated equipment, with a minimum of manual input. The use of industry standard leadframes is a key feature of this invention, since automated equipment in factories worldwide routinely accept plastic overmolded packages on standard leadframes.
- 3.2 An LED die is bonded to the ceramic using a silver-filled epoxy, or preferably, a metal solder with good thermal conductivity such as 80:20 Au:Sn eutectic.
- 3.3 Metal pads atop the LED die are connected to the ceramic, typically using 1 mil diameter gold wire. Gold ball bonding or wedge bonding are both suitable.
- 3.4 After a frame is fully populated with die, it can be moved to another work station where encapsulant and a lense are automatically placed atop the die. Features formed into the top of the metal (such as a ledge) can assist in the alignment of the lens.

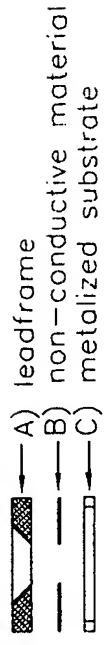
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A) detail of top layer(reflector)

View from topside



View from underside

DETAIL A: Exploded view of assembly
detail of one unit on leadframe

Process flow:

1. Apply dielectric material (B) to underside of leadframe (A). This material can be glass, epoxy or any non-conductive material. Non-conductive material may be applied by screening, spraying, roller coating, etc....
2. Item C, is a pattern metalized, electrically insulative material that will be placed onto material (B) that was deposited on the underside of the leadframe(A).
3. Once the entire leadframe(A) is populated it will be cured to achieve a mechanical/chemical bond with the leadframe (A).
4. The assembly is now ready for automated die and wire bond attach.
5. The leadframe may now be singulated into individual pieces by using a punch to remove the tie bars that hold the individual units into the leadframe. See Detail A.



C) detail of bottom layer(ceramic)

Bill Patinkin
1/22/03

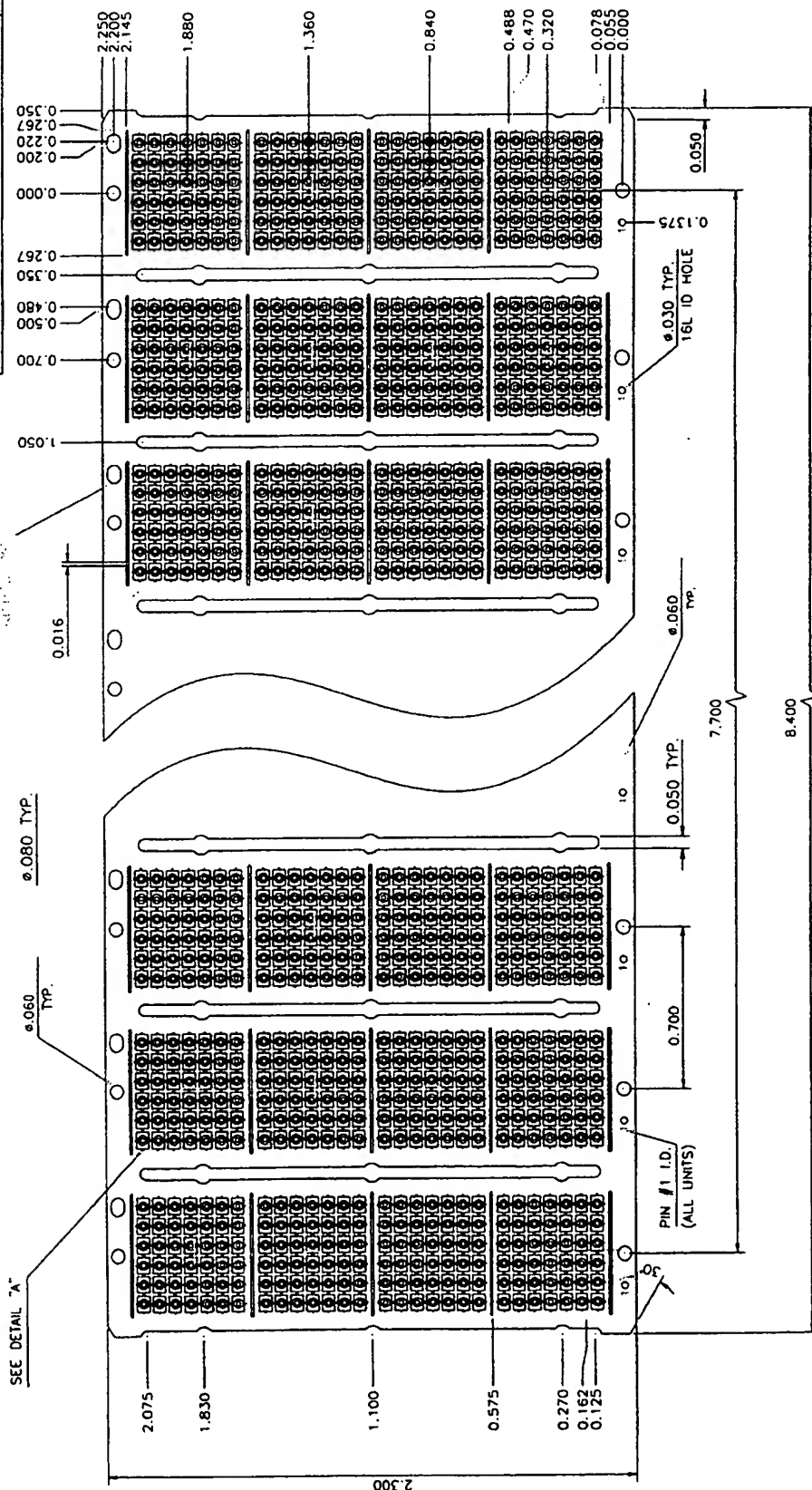
LED MATRIX LEADFRAME

Code Ident.	Size	Drawing No.	Rev.
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Scale: n/a	CU File Name:	Sheet 1	of 2

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FINISH = 125

XX =
X =
XXX =



Bu Palmtree
1/22/03

LED MATRIX LEADFRAME

Code Ident.	Size B	Drawing No	Rev 0
Scale: n/a	CAD File name: 161 SOL12 Sheet 1 of 2		

Joseph A. Tessari
Intellectual Property Counsel
Voice: 302-633-3566
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tyco

Electronics

Tyco Technology Resources
4550 New Linden Hill Road, Suite 140
Wilmington, DE 19808

24 April 2003

Via Courier

Joseph E. Chovanes, Esq.
Piper Rudnick
3400 Two Logan Square
18th and Arch Streets
Philadelphia, PA 19103-3762

Re: US Patent Appln. 09/864,123
Our Ref. 17539
Your Ref. N/A 1113-03

US Patent Appln. 09/696,930
Our Ref. 17548
Your Ref. N/A 1114-03

US Patent Appln. 10/098,098
Our Ref. 17781
Your Ref. 1235-02

PID Nos. 2003059; 2033072; 2003073

Dear Joe:

I enclose copies of Office Actions for the above cases. I also enclose copies of the applications and drawings for 17548 and 17539, which you were not earlier involved with.

- REDACTED -

I also enclose three new PIDs that need attention.

- REDACTED -

With respect to 2003073,

- REDACTED -

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Joseph E. Chovanes, Esq.
24.Apr.03

Page 2

Please provide cost estimates for each of these files before beginning any work.

Contact me if you have any questions.

Best Regards,

A handwritten signature in cursive script, appearing to read "Joe", written in black ink.

Joseph A. Tessari

Enclosures

DECLARATION/POWER OF ATTORNEY FOR UTILITY OR DESIGN PATENT APPLICATION (37 CFR 1.63)		Attorney Docket Number 18117
<input checked="" type="checkbox"/> Declaration Submitted with Initial Filing <input type="checkbox"/> Declaration Submitted after Initial Filing (surcharge (37 CFR 1.16(e)) required)		First Named Inventor William J. Palmteer
COMPLETE IF KNOWN		
		Application Number
		Filing Date Herewith (October 29, 2003)
		Group Art Unit
		Examiner Name

As a below named inventor, I hereby declare that:

My residence, mailing address, and citizenship are as stated below next to my name.

We believe we are the original, first and joint inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

the specification of which

☒ is attached hereto

OR

☐ was filed on _____ as United States Application Number _____ or PCT International Application Number _____ and was amended on (MM/DD/YYYY) _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.

I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or 365(b) of any foreign application(s) for patent or inventor's certificate, or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Certified Copy Attached?	
				YES	NO
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

☐ Additional foreign application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

I hereby claim the benefit under 35 U.S.C. 119(e) of any United States provisional application(s) listed below.

Application Number(s)	Filing Date (MM/DD/YYYY)

☐ Additional provisional application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

DECLARATION - Utility or Design Patent ApplicationDirect all correspondence to: ☐ Customer Number or ☒ Correspondence address belowName **Driscoll A. Nina, Jr., Esquire**Address **Tyco Technology Resources**Address **4550 New Linden Hill Road—Suite 140**City **Wilmington**State **DE**Zip **19808-2952**Country **US**Telephone **(302) 633 3566**Fax **(302) 633 2776****POWER OF ATTORNEY**

I hereby appoint the following practitioner(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith:

Driscoll A. Nina, Jr.	Registration No. 34685
Robert J. Kapalka	Registration No. 34198
Michael J. Aronoff	Registration No. 37770
Salvatore Anastasi	Registration No. 39090
T. Daniel Christenbury	Registration No. 31750
Paul A. Tauffer	Registration No. 35703
Frank A. Cons	Registration No. 38412
Darius C. Gambino	Registration No. 41472
James H. Bauersmith	Registration No. 50533

[x] I hereby appoint the practitioner(s) associated with Customer Number 035811 to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith.

[] Attached, as part of this Declaration and Power of Attorney, is the authorization of the above-named practitioner(s) to accept and follow instructions from my representative(s).

DECLARATION

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

☐ A petition has been filed for this unsigned inventor

Given Name (first and middle (if any))

William J.

Family Name or Surname

Palmtree

Inventor's Signature

William J. Palmtree

Date

10/27/03

Residence/City: N. Andover

State MA

Country USA

Citizenship USA

Mailing Address: 318 Turnpike Street

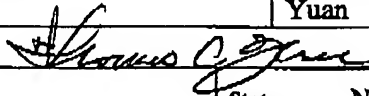
Mailing Address:

City N. Andover

State MA

Zip 01845

Country USA

NAME OF SECOND INVENTOR:		<input type="checkbox"/> A petition has been filed for this unsigned inventor	
Given Name (first and middle (if any)) Thomas		Family Name or Surname Yuan	
Inventor's Signature 		Date 10/27/2003	
Residence/City: Nashua	State New Hampshire	Country USA	Citizenship Taiwan, ROC
Mailing Address: 8 Bayberry Circle			
Mailing Address:			
City: Nashua	State New Hampshire	Zip 03062	Country USA
NAME OF ADDITIONAL JOINT INVENTOR, IF ANY:		<input type="checkbox"/> A petition has been filed for this unsigned inventor	
Given Name (first and middle (if any)) Richard		Family Name or Surname Koba	
Inventor's Signature		Date	
Residence/City: Saugus	State MA	Country USA	Citizenship USA
Mailing Address: 57 Walnut Street			
Mailing Address:			
City: Saugus	State MA	Zip 01906	Country USA
NAME OF ADDITIONAL JOINT INVENTOR, IF ANY:		<input type="checkbox"/> A petition has been filed for this unsigned inventor	
Given Name (first and middle (if any))		Family Name or Surname	
Inventor's Signature		Date	
Residence/City:	State	Country	Citizenship
Mailing Address			
Mailing Address			
City	State	Zip	Country
NAME OF ADDITIONAL JOINT INVENTOR, IF ANY:		<input type="checkbox"/> A petition has been filed for this unsigned inventor	
Given Name (first and middle (if any))		Family Name or Surname	
Inventor's Signature		Date	
Residence/City:	State	Country	Citizenship
Mailing Address			
Mailing Address			
City	State	Zip	Country

[] Additional inventors are being named on the _____ supplemental Additional Inventor(s) sheet(s) PTO/SB/02A attached hereto

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